

Application of the Weighted Moving Average Method Based on Digital Historical Data for Hijab Sales Prediction

Nur Tiara Annissa*, William Ramdhan, Abdul Karim Syahputra

Faculty of Computer Science, Information Systems, Royal Asahan University, North Sumatra, Indonesia
Email: ^{1*}tiaraannisaa28@gmail.com, ²william.ramdhan052@gmail.com, ³abdulkarim.syahputra@gmail.com
Email Penulis Korespondensi: tiaraannisaa28@gmail.com
Submitted 23-07-2025; Accepted 18-08-2025; Published 30-08-2025

Abstract

Business can be done by individuals or groups, in the form of small businesses, large companies, or even as individual entrepreneurs. Syakila Hijab Store is one of the businesses engaged in the Muslim fashion sector, especially in providing hijab and Muslim clothing. In the retail industry, the ability to predict sales is very important to optimize stock, reduce the risk of excess or lack of inventory, and increase operational efficiency. Forecasting is making estimates for future testing with past data. The Weighted Moving Average method is generally used to find trends from a time series. This method is used for data that has characteristics that do not change quickly, and do not have seasonal data characteristics. With the existence of a forecasting system that is designed to reduce the problems that occur, it is known that the current problem is the availability of the number of hijab stocks at the Syakila Hijab store which cannot meet consumer demand or excess hijab inventory on certain brands. Inventory pays attention to market demand, to find out market demand a trading business conducts sales forecasting, namely to estimate how much sales might occur in the coming period. A low score indicates a minor error in the prediction.

Keywords: Business; Syakila Hijab Shop; Forecasting; Weighted Moving Average Method

1. INTRODUCTION

Business is an activity carried out to achieve certain goals, either by individuals or business entities [1]. Business can be in the form of activities carried out to fulfill daily needs, as well as to make a profit [2]. Business is an economic activity carried out to produce, buy, or sell goods or services with the aim of making a profit [3]. Businesses can be conducted by individuals or groups, in the form of small businesses, large companies, or even as individual entrepreneurs [4]. Syakila Hijab shop is one of the businesses engaged in Muslim fashion, especially in providing hijab and Muslim clothing. In the retail industry, the ability to predict sales is very important to optimize stock of goods, reduce the risk of excess or shortage of inventory, and improve operational efficiency. Errors in sales forecasting can negatively impact profitability and customer satisfaction [5]. Syakila Hijab is a shop that sells various types of hijab with various models and color variants that make women interested, this shop was founded by Mrs. Lidia in 2019 until now.

The current problem is that the sales forecasting process at Toko Syakila Hijab is still done manually and subjectively, the imbalance between the amount of stock and customer demand often occurs due to inaccurate forecasting [6]. The absence of a data-based system that can assist management in making sales predictions more effectively [7]. Syakila Hijab shop still uses conventional methods in estimating the amount of goods that must be provided. Forecasting is making estimates for future testing with data in the past [8]. In social life, it is difficult to predict precisely, so forecasting is needed [9].

In an increasingly competitive business world, having an effective strategy in managing inventory and forecasting sales is a key factor in the success of a business. If there is no accurate prediction system, then stock management will be less efficient, causing a buildup of unsold goods or vice versa, stock shortages when demand increases [10]. This can have a negative impact on the company's image, especially if customers have difficulty getting the products they need.

Information technology has made it possible to process large amounts of data more quickly and accurately. The Weighted Moving Average (WMA) method has been widely used in various fields, including in the retail business, to predict sales based on historical data [11]. This method gives greater weight to the most recent data, making it more responsive to changes in trend and more accurate than the simple average method [12].

The superiority of the WMA method in sales forecasting has been proven in various industry sectors. Its use allows businesses to make decisions based on actual data, not just subjective estimates. By applying this method, Toko Syakila Hijab can better anticipate market demand and adjust their business strategy more effectively [13].

Another advantage of applying the WMA method in sales forecasting is its ability to reduce waste in stock management [14]. By having a more accurate forecast of which products are in high demand in a given period, management can allocate resources more efficiently [15]. This can reduce operating costs and improve overall business profitability.

The forecasting conducted by Silvya et al [16] which used the weighted moving average method to forecast inventory production, concluded that forecasting can help producers understand market demand conditions. The information generated from WMA has been tested for prediction accuracy, so the results are consistent and accurate. This predictive information serves as input data for further distribution optimization; however, in their research, they did not include a graph to compare the original data with the forecast results.

The purpose of this study was to design a hijab stock forecasting system using the Weighted Moving Average (WMA) method at the Syakila Hijab Shop using the PHP programming language and MySQL database and implement a Weighted Moving Average (WMA) method forecasting system that can help the Syakila Hijab Shop in optimizing the stock of hijab provision.

2. RESEARCH METHOD

This research uses quantitative methods with the research stages as shown in Figure 1 below.

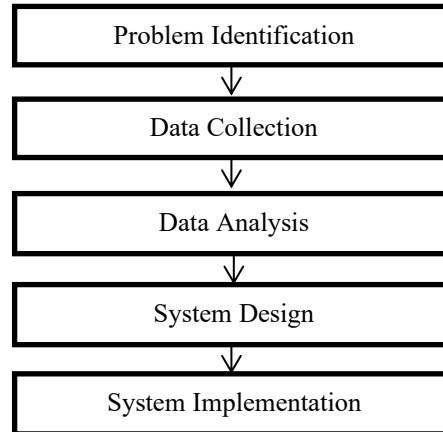


Figure 1. Research Method

2.1 Problem Identification

Identifying issues faced by Syakila Hijab Shop, namely mismatches between hijab stock and market demand due to manual forecasting.

2.2 Data Collection

Gathering monthly hijab sales data from January 2024 to February 2025 as historical data for forecasting.

Table 1. Sales Hijab Data 1 Year Before

No	Periode	Hijab Segi4 Polos (Pcs)	Hijab Segi4 Motif (Pcs)	Hijab Pashmina (Pcs)	Hijab Instant (Pcs)
1	Feb-2024	30	15	20	25
2	Mar-2024	31	18	20	22
3	Apr-2024	31	20	20	23
4	Mei-2024	33	19	23	28
5	Jun-2024	34	20	20	22
6	Jul-2024	32	19	22	27
7	Aug-2024	32	16	21	26
8	Sep-2024	33	18	22	25
9	Oct-2024	31	15	24	24
10	Nov-2024	25	20	25	26
11	Dec-2024	30	15	26	23
12	Jan-2025	31	16	28	25
13	Feb-2025	30	15	26	25

2.3 Data Analysis

Analyzing the data using the Weighted Moving Average (WMA) method to generate sales predictions for the following month, and calculating forecast accuracy using Mean Absolute Deviation (MAD), Mean Squared Error (MSE), and Mean Absolute Percentage Error (MAPE) [17]:

2.3.1 Forecast

The Weighted Moving Average algorithm is a time series forecasting method that assigns greater weight to more recent data compared to older data. Its working principle involves multiplying each historical data point by a weight according to its time order, summing the results, and dividing by the total weight. This method is suitable for relatively stable data without strong seasonal patterns and is more responsive to trend changes than the Simple Moving Average. The main advantage of WMA lies in its ability to reflect recent market trends, resulting in more accurate predictions for inventory planning. Forecasting can be calculated using the formula [16]:

$$\text{WMA (n)} = \frac{\sum (x_t) (w)}{\sum w} \quad (1)$$

Where:

Xt = Actual data at a certain period (t)

W = Weight

2.3.2 Mean Absolute Deviation

MAD can be calculated using the formula:

$$\text{MAD} = 1/n \sum_{t=1}^n |e_t| \quad (2)$$

Where:

et = Error in period t

n = Number of periods

t = time of periods

2.3.3 Mean Sequence Error (MSE)

MSE can be calculated using the formula:

$$\text{MSE} = 1/n \sum_{t=1}^n |e_t|^2 \quad (3)$$

Where:

et = Error in period t

n = Number of periods

t = time of periods

2.2.3 Mean Absolute Percentage Error (MAPE)

MAPE can be calculated using the formula:

$$\text{MAPE} = 1/n \sum_{t=1}^n |e_t / x_t| \times 100\% \quad (4)$$

Where:

Xt = Actual data at a certain period (t)

et = Error in period t

n = Number of periods

t = time of periods

2.4 System Design

Designing a web-based forecasting system using UML diagrams, flowcharts, ERD, and interface mockups to facilitate implementation.

2.5 System Implementation

Developing the system using PHP programming language, MySQL database, and integrating the WMA algorithm into the program code.

3. RESULT AND DISCUSSION

3.1 Design System

System design using use case diagrams with the help of MS tools. Visio tools. The purpose of designing a system using a use case diagram is to clearly describe the functional requirements of the system through interactions between actors and the system. System design using use case diagrams as in Figure 2 below.

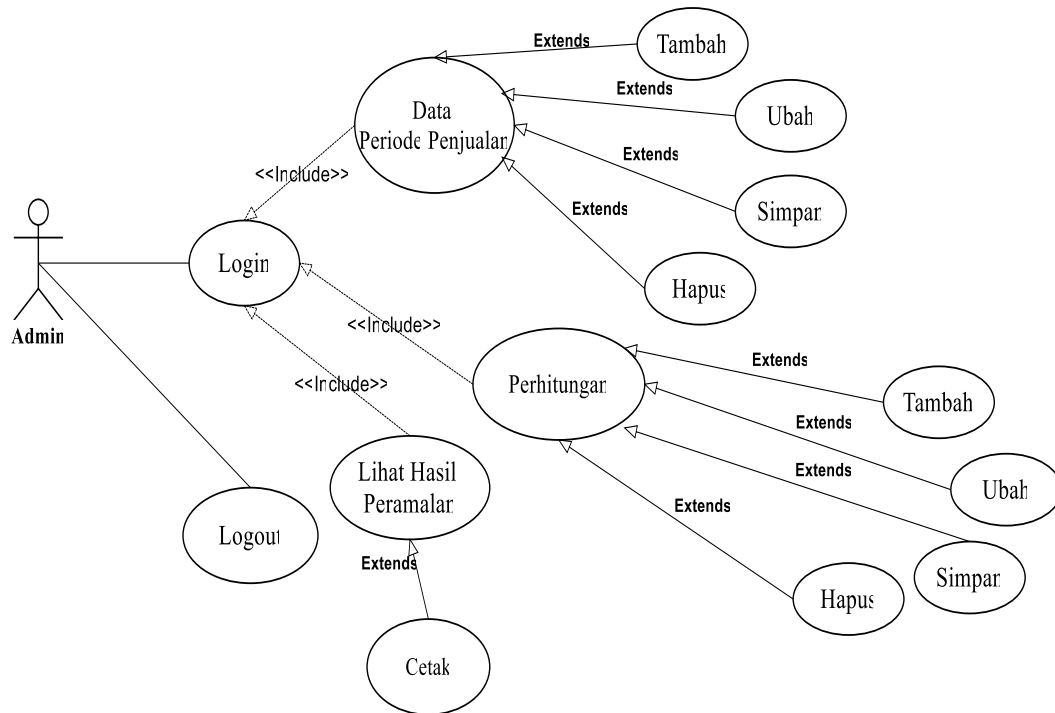


Figure 2. Use Case Diagram

Figure 2 illustrates the use case diagram of the hijab stock forecasting system using the Weighted Moving Average (WMA) method at Syakila Hijab Shop. This diagram depicts the interaction between the actor (admin) and the system in carrying out the method's stages, starting from entering historical sales data, performing forecasting calculations using WMA, to presenting the prediction results in table and graph formats. The process also includes testing the forecasting results using evaluation metrics such as Mean Absolute Deviation (MAD), Mean Squared Error (MSE), and Mean Absolute Percentage Error (MAPE) to ensure method accuracy.

3.2 Weight Moving Average Stage

The application of the Weighted Moving Average (WMA) method in this study was carried out through the following stages:

- Assigning weights to each period of historical sales data, with more recent data receiving higher weights.
- Multiplying each period's sales data by its assigned weight to obtain the weighted values.
- Summing the weighted values and dividing by the total weight to produce the forecast value for the next period.
- Calculating the error values between the actual data and the forecast results for each period using three evaluation metrics:
 - Mean Absolute Deviation (MAD) to measure the average absolute error.
 - Mean Squared Error (MSE) to measure the average squared error.
 - Mean Absolute Percentage Error (MAPE) to measure the percentage error relative to the actual data.
- Evaluating the forecasting results to determine the accuracy level of the method used.

Results of Applying the WMA Method. Based on hijab sales data from February 2024 to February 2025, the system produced a sales forecast for March 2025 of 15.33 units for the Hijab Segi4 Motif product (as shown in Table 2). The obtained MAD value was 1.82, MSE was 5.05, and MAPE was 10.58%, indicating a relatively low prediction error (< 20%), thus the WMA method can be considered reasonably accurate for forecasting hijab demand. These testing results demonstrate that applying the WMA method can help Syakila Hijab Shop better anticipate stock requirements, minimize the risk of overstocking or stockouts, and improve inventory management efficiency.

3.3 Forecast, MAD, MSE and MAPE

To measure the distance between the data and the cluster center, the Euclidian distance is used, for example on the following Kavolux Standing Fan products:

Table 2. Hijab Forecast

Period	Stock	Ft	Error	Abs Error	Error^2	MAPE (%)
Feb-24	15	-				

Mar-24	18	-				
Apr-24	20	17.00	-3	3.00	9.00	15%
May-24	19	19.33	0	0.33	0.11	2%
Jun-24	20	19.33	-1	0.67	0.44	3%
Jul-24	19	19.67	1	0.67	0.44	4%
Aug-24	16	19.33	3	3.33	11.11	21%
Sep-24	18	17.00	-1	1.00	1.00	6%
Oct-24	15	17.33	2	2.33	5.44	16%
Nov-24	20	16.00	-4	4.00	16.00	20%
Dec-24	15	18.33	3	3.33	11.11	22%
Jan-25	16	16.67	1	0.67	0.44	4%
Feb-25	15	15.67	1	0.67	0.44	4%
TOTAL				20.00	55.56	116.4%
Maret 2025	Prediction	15.33				
	MAD	1.82				
	MSE	5.05				
	MAPE(%)	10.58%				

In this study, hijab sales forecasting was conducted using the Weighted Moving Average (WMA) method. The WMA formula works by assigning higher weights to more recent data compared to older data, making the prediction more responsive to trend changes.

For example, to forecast sales for May 2024 of the Plain Square Hijab product, sales data from the three previous months (February–April 2024) were used with respective weights of 1, 2, and 3. The calculation steps are as follows:

- Multiply each sales figure by its weight:
 - February 2024: $15 \times 1 = 15$
 - March 2024: $18 \times 2 = 36$
 - April 2024: $20 \times 3 = 60$
- Sum the weighted values: $15 + 36 + 60 = 111$
- Sum the total weights: $1 + 2 + 3 = 6$
- Divide the total weighted value by the total weight: $111 \div 6 = 18.50$ (forecast for May 2024).

Forecast accuracy was then calculated using three indicators:

- Mean Absolute Deviation (MAD) measures the average absolute error between actual and predicted data.
- Mean Squared Error (MSE) measures the average squared error, giving more weight to large errors.
- Mean Absolute Percentage Error (MAPE) measures error as a percentage of the actual data.

From the complete sales data from February 2024 to February 2025, the results were MAD = 1.82, MSE = 5.05, and MAPE = 10.58%. A MAPE value below 20% indicates that the WMA method produces reasonably accurate predictions for decision-making in stock management at Syakila Hijab Shop.

3.4 Implementation

This forecasting system was created using the PHP, with Microsoft Visual Studio Code as the text editor and mysql as the database.

3.5.1 Clustering Graphics

In the forecasting graph there are 2 line colors, the black line color is the forecasting data and the blue line is the actual data as shown in Figure 3 below.

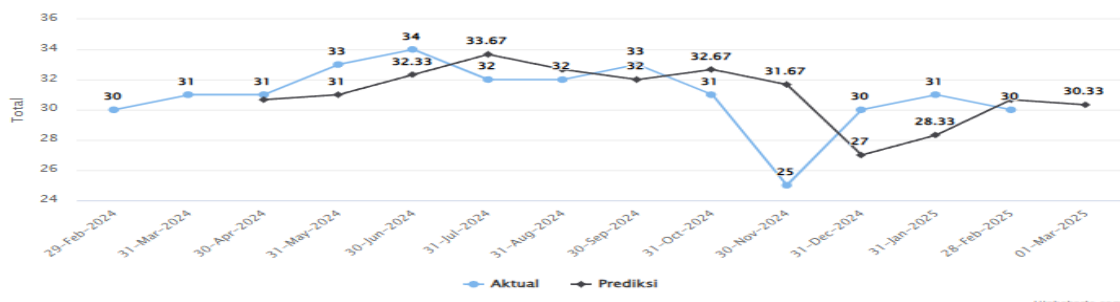


Figure 3. Graphics Forecasts

Figure 3 presents a comparison graph between actual sales data and forecasting results using the Weighted Moving Average (WMA) method at Syakila Hijab Shop. The blue line represents actual sales data, while the black line shows the forecasted results. The differences between these two lines were measured using Mean Absolute Deviation (MAD), Mean Squared Error (MSE), and Mean Absolute Percentage Error (MAPE).

For example, to forecast sales for May 2024 of the Plain Square Hijab product, sales data from the three previous months (February–April 2024) were used with weights of 1, 2, and 3. The weighted values ($15 + 36 + 60 = 111$) were summed and divided by the total weight (6), resulting in a forecast of 18.50 units. From the full dataset covering February 2024 to February 2025, the results were $MAD = 1.82$, $MSE = 5.05$, and $MAPE = 10.58\%$, indicating a relatively low prediction error ($< 20\%$). This graph illustrates that the WMA method can effectively follow sales trends with reasonable accuracy.

4. CONCLUSION

From this study, it can be concluded that the forecasting system designed aims to reduce the problems that occur. It is known that the current problems are the availability of hijab stock at Syakila Hijab stores that cannot meet consumer demand or excess stock of hijabs of certain brands. Inventory takes into account market demand to determine market demand from trading businesses in order to forecast sales, i.e., to estimate how many sales are likely to occur in the coming period. The web-based forecasting application generates an effective and efficient hijab stock provisioning process, a fast forecasting process, and can assist in the hijab demand forecasting process with ease. These results align with research conducted by Sylvia, who applied forecasting using the WMA method to help understand market demand conditions. However, their research did not include forecasting graphs in the system they developed, whereas this study already has forecasting graphs to facilitate Syakila Hijab store in reading and viewing forecasting data.

REFERENCES

- [1] D. A. Hidayanti, H. Syafwan, and A. Akmal, "Penerapan Metode Weighted Moving Average pada Sistem Peramalan Stok Bahan Laundry," *Edumatic*, vol. 8, no. 1, pp. 153–162, 2024, doi: 10.29408/edumatic.v8i1.25636.
- [2] Z. E. Elisa, E. Kurniawan, and M. D. Sena, "FORECASTING GAMIS DEMAND IN FASHION GALLERY USING WEIGHTED MOVING AVERAGE," *JURTEKSI (Jurnal Teknol. dan Sist. Inf.)*, vol. X, no. 2, pp. 323–330, 2024.
- [3] I. T. Tazkiyah, A. E. Wardoyo, and B. S. Rintyarna, "Implementing Moving Average Forecasting System for Apparel Sales : Predicting Inventory Needs with Enhanced Accuracy," *Sink. J. dan Penelit. Tek. Inform.*, vol. 8, no. 3, pp. 1346–1356, 2024.
- [4] S. Sahara, R. A. Permana, M. Marlina, and J. Jamaludin, "Prediksi Persediaan Barang Menggunakan Indikator Moving Average Studi Kasus Department Store," *J. Teknol. Sist. Inf.*, vol. 5, no. 1, pp. 171–180, 2024, doi: 10.35957/jtsi.v5i1.7811.
- [5] N. Hidayat, Muhammad Ammar Rizki, and Ageng Priyo Wijaya, "Analisis Peramalan dalam Menentukan Perencanaan Persediaan pada Toko Seragam Sekolah Hermul Jaya," *El-Mal J. Kaji. Ekon. Bisnis Islam*, vol. 5, no. 5, pp. 3267–3273, 2024, doi: 10.47467/elmal.v5i5.1256.
- [6] A. Dzulfikar, M. Orisa, and F. Santi Wahyuni, "Aplikasi Peramalan Untuk Prediksi Stok Di Perusahaan Percetakan Berbasis Web Dengan Metode Trend Moment," *JATI (Jurnal Mhs. Tek. Inform.)*, vol. 7, no. 5, pp. 3182–3190, 2024, doi: 10.36040/jati.v7i5.7645.
- [7] Noviadry Nur Tamtama and Rahmawati Riantisari, "Analisis Peramalan Permintaan Melalui Metode Moving Average, Weighted Moving Average dan Exponential Smoothing (Studi Kasus Pada Exist Auto Detailing)," *Primanomics J. Ekon. Bisnis*, vol. 22, no. 1, pp. 109–120, 2024, doi: 10.31253/pe.v22i1.2685.
- [8] D. Adrian, R. Chiesa, S. Achmadi, and J. Dedy Irawan, "Sistem Peramalan Penjualan Pakaian Wanita Menggunakan Metode Double Exponential Smoothing (Studi Kasus Pada Ime Female Fashion)," *J. Mhs. Tek. Inform.*, vol. 7, no. 4, pp. 2319–2324, 2023.
- [9] A. S. Pranata, N. O. Adiwijaya, and M. Furqon, "Sistem Peramalan Stok Kaos Sablon dengan Weight Moving Average," *J. Komput. Terap.*, vol. 9, no. 1, pp. 50–57, 2023, doi: 10.35143/jkt.v9i1.5834.
- [10] F. Hamidy and I. Yasin, "Implementation of Moving Average for Forecasting Inventory Data Using CodeIgniter," *J. Data Sci. Inf. Syst.*, vol. 1, no. 1, pp. 17–23, 2023, doi: 10.58602/dimis.v1i1.17.
- [11] D. Erdianita, R. Mumpuni, and F. P. Aditiawan, "Sistem Prediksi Penjualan Menggunakan Metode Weighted Moving Average Dan Economic Order Quantity Pada Toko Mariah," *JIP (Jurnal Inform. Polinema)*, vol. 9, no. 4, pp. 363–372, 2023, doi: 10.33795/jip.v9i4.1311.
- [12] N. Khoerudin, S. P. Ramadhani, M. Hasian, V. H. M. Sinaga, and D. M. Kusumawardani, "Analisis Rantai Pasok Penjualan Sepatu Sekolah Masa Pandemi Covid-19 dengan Metode Weighted Moving Average," *JURIKOM (Jurnal Ris. Komputer)*, vol. 10, no. 1, pp. 2407–389, 2023, doi: 10.30865/jurikom.v10i1.5456.
- [13] G. Umar Ramadoni, P. Korespondensi, U. Ramadoni, D. Aliefatan, A. Adi Saputro, and B. Jakarta Raya, "Usulan Perancangan Sistem Inventory Barang Di Toko Sepatu Bansun Sport," *J. Ilm. Mhs. Sist. Inf. dan Komput. Akunt.*, vol. 1, no. 2, pp. 56–62, 2023, [Online]. Available: <https://doi.org/10.33365/jimasika.v1i2.3338>
- [14] A. Paramitha and J. A. Saifuddin Z.S, "Forecasting Analysis of Car Wheel Rim Demand At Pt. Xx To Reduce Waste Using Pom-Qm Software," *Barometer*, vol. 8, no. 2, pp. 87–94, 2023, doi: 10.35261/barometer.v8i2.7702.
- [15] M. V. Syahanifadhel, D. E. Basuki, B. A. Hasna, and A. Azzam, "Analisis Perencanaan Produksi Pada Produk Kemeja Pola Menggunakan Metode Forecasting Dan Master Production Schedule Untuk Penjadwalan Produksi Pada CV. Jodion Unggul Perkasa," *J. Tek. Ind. J. Has. Penelit. dan Karya Ilm. dalam Bid. Tek. Ind.*, vol. 9, no. 1, p. 95, 2023, doi: 10.24014/jti.v9i1.21890.
- [16] Z. Silvya, A. Zakir, and D. Irwan, "Penerapan Metode Weighted Moving Average Untuk Peramalan Persediaan Produk Farmasi," *JITEKH*, vol. 8, no. 2, pp. 59–64, 2020, doi: 10.35447/jitekh.v8i2.220.
- [17] S. Nurhayati and A. Syafiq, "Clothing Production Amount Prediction System using Weighted Moving Average," *J. Manaj. Inform.*, vol. 12, no. 1, pp. 14–24, 2022, doi: 10.34010/jamika.v12i1.6680.